

REMARKS

This Amendment is submitted in response to the outstanding Office Action, dated June 28, 2006. The present application was filed on December 18, 2001 with claims 1-21. Claims 5-8 and 11-20 have been previously cancelled, without
 5 prejudice. Claims 1-4, 9-10, and 21-34 are presently pending in the above-identified patent application. In this response, Applicants propose to amend claim 26.

This amendment is submitted pursuant to 37 CFR §1.116 and should be entered. The only proposed amendment herein is to address a Section 112 issue, in the exact manner suggested by the Examiner. The Amendment places all of the pending
 10 claims, i.e., claims 1-4, 9-10, and 21-34, in a form that is believed allowable, and, in any event, in a better form for appeal. It is believed that examination of the pending claims as amended, which are consistent with the previous record herein, will not place any substantial burden on the Examiner.

In the Office Action, the Examiner rejected claim 26 under 35 U.S.C.
 15 §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. In addition, the Examiner noted that the prior response failed to include the resubmitted formal drawings. The Examiner rejected claims 1, 21, 26, 27 and 33 under 35 U.S.C. §103(a) as being unpatentable over Chevillat (United States Patent No. 5,031,195) in view of Kim
 20 (United States Patent No. 5,963,592). Claims 2-4, 9, 10, 22-25 and 34 were rejected under 35 U.S.C. §103(a) as being unpatentable over Chevillat in view of Eyuboglu (United States Patent No. 4,713,829). The Examiner indicated that claims 28-32 would be allowable if rewritten in independent form.

Section 112 Rejection

25 The Examiner rejected claim 26 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The Examiner asserts that the term “survivor path into a state” is incomprehensible. Claim 26 has been amended in accordance with the Examiner’s suggestion, and Applicants respectfully request
 30 withdrawal of the Section 112 rejection.

Drawings

The Examiner noted that the prior response failed to include the resubmitted formal drawings. Applicants are resubmitting formal drawings herewith, that reflect previously submitted amendments and which do not contain any handwriting.

5 Entry of the formal drawings is respectfully requested.

Section 103 Rejection

The Examiner rejected claims 1, 21, 26, 27 and 33 under 35 U.S.C. §103(a) as being unpatentable over Chevillat in view of Kim. With regard to claims 1 and 21, for example, the Examiner asserts that Chevillat teaches compensating for intersymbol interference caused by previously transmitted multidimensional code symbols (citing Abstract and col. 5, lines 8-17 and 46).

The Examiner acknowledges that Chevillat does not explicitly teach the use of taking specific compensatory actions for intrasymbol interference. The Examiner asserts, however, that Kim teaches compensation for intrasymbol interference (citing col. 9, lines 8-13).

Intersymbol Interference Compensation

The present invention compensates for the intersymbol interference caused by previously transmitted multidimensional code symbols *by calculating intersymbol interference estimates based on one or more multidimensional code symbols*. Independent claims 1, 21 and 33 require that a multidimensional code symbol comprises a “number of symbol components of lower dimensionality.”

Applicants submit that Chevillat is not directed to multi-dimensional code symbols, as defined in the independent claims. Chevillat addresses using a 16 QASK signal constellation (see col. 8, lines 1-7 and FIG. 3), where each two-dimensional symbol from the 16 QASK signal constellation comprises in-phase (I) and quadrature (Q) coordinates. The I and Q coordinates are merely conceptual abstractions and are not symbol components of lower dimensionality, as defined in claim 1 and the specification. Therefore, the 2-D symbols from the 16 QASK constellation in Chevillat do not comprise a number of symbol components of lower dimensionality, as required by each independent claim.

In addition, Chevillat does not explicitly teach the use of taking specific

compensatory actions for intrasymbol interference, as acknowledged by the Examiner.

Intrasymbol Interference Compensation

Independent claims 1, 21 and 33 also require compensating for intrasymbol interference caused by symbol components within a current multidimensional code symbol. The Examiner asserts that Kim teaches compensation for intrasymbol interference (citing col. 9, lines 8-13).

In order to establish a *prima facie* case of obviousness, the following three criteria must be met:

[f]irst, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

M.P.E.P. §2143. Appellants respectfully submit that the Examiner has failed to establish a *prima facie* case of obviousness for at least the reason that there exists no motivation to combine the references, and further, even if combinable, the references collectively do not teach each and every limitation of the independent claims. Also, there is no reasonable expectation of success.

Applicants submit that the references, when combined, do not disclose or suggest compensating for intrasymbol interference caused by symbol components within a current multidimensional **code** symbol. As indicated by Applicants in the prior response (but not addressed at all by the Examiner in the current Office Action), *Kim is not even directed to a coded system!* Thus, Kim does not disclose or suggest compensating for intrasymbol interference within multidimensional **code** symbols. Kim defines intrasymbol interference in the context of in-phase and quadrature-phase filtering in an OFDM transceiver without consideration of coding. Applicants respectfully request the Examiner to specifically identify any suggestion of a multidimensional code in Kim.

Applicants further submit that there exists no motivation to combine the references. The Examiner asserts that it would be obvious to modify Chevillat with the teachings of Kim by including use of taking specific compensatory actions for intrasymbol interference, because one of ordinary skill in the art would have recognized

that such compensatory actions would have provided adaptation for abrupt changes in the channel.

First, since Kim is not even directed to a coded system, a person of ordinary skill in the art would not even look to Kim for a solution to the problem addressed by the present invention, namely, the decoding of multidimensional codes. Thus, a person of ordinary skill would not combine Chevillat and Kim.

Second, the Examiner seems to rely on the general notion that “intersymbol and intrasymbol interference are a type of noise due to multi-path fading, causing errors in the received data,” in support of a motivation to combine. Applicants note, however, that intersymbol and intrasymbol interference are distinct and independent types of channel impairments, each requiring specific treatment. A solution that compensates for intersymbol interference does not suggest a solution that compensates for intrasymbol interference, and vice versa.

Also, there is no reasonable expectation of success for the combination of Chevillat and Kim. Kim suggests to “to remove intrasymbol interference by updating the in-phase and quadrature phase filtering coefficients by utilizing the pilot signal,” which is different from “compensating for intrasymbol interference caused by symbol components within a current multidimensional code symbol.” Kim addresses the removal of intrasymbol interference for an uncoded symbol comprising I and Q coordinates, whereas claim 1 addresses the compensation of intrasymbol interference caused by symbol components within a current multidimensional code symbol. It is not clear to Applicants how the removal of in-phase and quadrature-phase filtering coefficients by utilizing the pilot signal leads to the compensation of intrasymbol interference caused by symbol components within a current code symbol. Therefore, there is no reasonable expectation of success.

Thus, Applicants respectfully request withdrawal of the Section 103 rejection.

Dependent Claims 2-4, 9-10 and 22-32 and 34

The Examiner rejected dependent claims 26 and 27 under 35 U.S.C. §103(a) as being unpatentable over Chevillat in view of Kim. Dependent claims 2-4, 9, 10, 22-25 and 34 were rejected under 35 U.S.C. §103(a) as being unpatentable over

Chevillat in view of Eyuboglu. Claims 2-4, 9-10, and 22-23 and 34 are dependent on claims 1, or 33 and are therefore patentably distinguished over Chevillat, Eyuboglu and Kim (alone or in combination) because of their dependency from independent claims 1 or 33 for the reasons set forth above, as well as other elements these claims add in combination to their base claim.

For example, with regard to claim 26, the Examiner asserts that Chevillat teaches that ISI terms not represented the truncated surviving path are subtracted to create ISI free estimates. With regard to claim 27, the Examiner further notes that past symbols are first symbols and current symbols are subsequent. The recited passage of Chevillat merely describes channel truncation as a means to reduce decoder complexity. Chevillat does not disclose or suggest calculating an intersymbol interference-free estimate using at least one survivor symbol from a survivor path, as required by claim 26.

With regard to claim 2, the Examiner asserts that Eyuboglu teaches the user of multidimensional Trellis code constellations (citing col. 8 and 4D block encoder 97 in FIG. 7). Eyuboglu, however, does not disclose or suggest that multidimensional code symbols are transmitted over more than one symbol interval that is used to transmit one of said symbol components.

A 4-D constellation need not be transmitted over more than one transmission frame. A 4-D symbol comprising four 1-D pulse amplitude modulation (PAM) symbols can be transmitted over four channels in one symbol interval that is used to transmit one 1-D symbol component. A 4-D symbol comprising two 2-D quadrature amplitude modulation QAM signals can be transmitted over two channels in one symbol interval that is used to transmit one of the 2-D symbol components.

With regards to claims 3 and 34, the Examiner asserts that Eyuboglu teaches a modulator for providing in-phase and quadrature coordinates or channels (citing col. 6, lines 15-16, col. 8 and 4D block encoder 97 in FIG. 7). Eyuboglu, however, does not disclose or suggest that the multidimensional code symbol comprises a number of transmitted symbol components of lower dimensionality that exceeds a number of available channels. In-phase I and quadrature Q coordinates are conceptual coordinates of a 2D QAM symbol and not symbol components or channels. For example, the in-phase I coordinate is not transmitted over the channel, but the 2-D QAM symbol is. Also,

the Q-phase coordinate is not transmitted over the channel, but the 2-D QAM symbol is.

With regards to claim 4, the Examiner asserts that Eyuboglu (citing col. 4, lines 61-65) and Kim (citing col. 9, lines 8-13) teach calculating intrasymbol interference estimates based on possible data symbol values; and calculating branch metrics based on a received signal and said intersymbol interference and intrasymbol interference estimates (citing Eyuboglu col. 3, lines 1-2).

The phrase "Updating the in-phase and quadrature phase filtering coefficients" in Kim has no resemblance to the recited step of "calculating intrasymbol interference estimates based on possible data symbol values".

Further, Eyuboglu, Col. 3, lines 1-2 says that "the branch metric computations will take account the presence of ISI". This passage of Eyuboglu does not disclose or suggest intrasymbol interference estimates at all. Figure 4 of Eyuboglu does not suggest that branch metric are computed based on intrasymbol interference estimates, and Eyuboglu does not disclose or suggest that intrasymbol interference is present.

With regard to Claim 10, Eyuboglu, Col 3, lines 56-61 does not teach claim 10, that is using a 4D TCM multidimensional code.

The Examiner has not addressed Applicants prior comments regarding claims 22 and 23 at all.

For example, with regard to claim 22, the Examiner asserts that Eyuboglu discloses predictor coefficients that are metrics that use previous surviving received signals $r_{1, \text{old}}$ and $r_{2, \text{old}}$. $r_{1, \text{old}}$ and $r_{2, \text{old}}$ are previous received signals (col. 11, lines 9-18), not survivor symbols. Eyubogly does not define nor introduce the terms "surviving received signals" or "surviving received symbols" and these terms are also not defined in the art. The term "survivor symbols" is however clearly defined in the Specification, page 9, lines 20-26, as symbols that form the survivor path. Therefore, Eyuboglu, does not use "survivor symbols from a corresponding state," as required by claim 22.

With regard to claim 23, the Examiner asserts that $r_{1, \text{old}}$ and $r_{2, \text{old}}$ are surviving symbols. $r_{1, \text{old}}$ and $r_{2, \text{old}}$, however, are previous received signal and not survivor symbols. Generally, a survivor symbol is a symbol belonging to the survivor path into a state, as would be apparent to a person of ordinary skill in the art.

Survivor symbols are also defined as such in the Specification at page 9, lines 20-26. Further, $r_{1, \text{new}}$ and $r_{2, \text{new}}$ are not data estimates, but currently received signals as defined in col. 11, line 9-18.

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The Examiner indicated that claims 28-32 would be allowable if rewritten in independent form.

Conclusion

10 All of the pending claims following entry of the amendments, i.e., claims 1-4, 9-10, and 21-34, are in condition for allowance and such favorable action is earnestly solicited.

If any outstanding issues remain, or if the Examiner has any further suggestions for expediting allowance of this application, the Examiner is invited to contact the undersigned at the telephone number indicated below.

15 The Examiner's attention to this matter is appreciated.

Respectfully submitted,



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